

Falls, 22.8; Baker City, 28.8; Winnemucca, 31.8; Spokane, 32.8; Salt Lake City, 33.6; Carson City, 33.9; Port Angeles, 38.2; Tatoosh Island, 39.0; Portland, Oreg., 40.5; Fort Canby, 40.9; Astoria, 41.6; Eureka, 45.2; Point Reyes Light, 46.8; Red Bluff, 47.9; Fresno, 48.6; San Francisco, 48.9; Phoenix, 54.3.

The *maximum and minimum temperatures* of the current month are given in Table I. The highest maxima were: 92, Corpus Christi (21st), San Antonio (30th); 88, Tampa (16th), Jacksonville (20th), Jupiter (23d); 87, Augusta (21st); 86, Savannah, Jacksonville, and Shreveport (20th), Charleston, (21st), Yuma (25th), Vicksburg (30th). The lowest maxima were: 42 Duluth (21st); 46, Havre (28th), Eastport (30th); 47, Williston (29th); 48, Idaho Falls (25th), Bismarck (29th); 49, Northfield (19th), Block Island and Marquette (29th). The highest minima were: 65, Key West (28th); 51, Galveston (23d); 50, Tampa (1st), Port Eads, (frequently), New Orleans (25th); 49, Jupiter (27th). The lowest minima were: -41, Havre (13th); -36, Bismarck (15th); -35, Williston (14th); -32, Moorhead (15th); -26, Miles City (13th); -25, Huron (14th).

The *limits of minimum temperatures*, 32° and 40°, are shown by lines on Chart No. V.

The *years of highest maximum and lowest minimum temperatures* for March are given in the last four columns of Table I of the REVIEW for 1896. During the current month the maximum temperatures were equal to or above the highest on record at: Corpus Christi, 92; Jacksonville, Tampa, and Jupiter, 88; Vicksburg and Charleston, 86; New Orleans, 84. The minimum temperatures were equal to or below the lowest on record at: Havre, -41; Bismarck, -36; Williston, -35; Moorhead, -32; Miles City, -26; Huron, -25; Northfield, -18; Idaho Falls, -16; Baker City, 0; Carson City, 10; Astoria, 24.

The *greatest daily range of temperature and the data for computing the extreme and mean monthly ranges* are given for each of the regular Weather Bureau stations in Table I. The largest values of the greatest daily ranges were: Havre, 57; Williston, 53; Dodge City, 47; Northfield, 46; Rapid City, 44; Sioux City, Wichita, Pueblo, and El Paso, 43. The smallest values were: Tatoosh Island, 11; Key West, 13; Fort Canby and Point Reyes Light, 14; San Francisco, 15; Astoria and Galveston, 19; Port Eads and Nantucket, 20.

Among the *extreme monthly ranges* the largest were: Havre, 87; Moorhead, 86; Bismarck and Rapid City, 84; Williston, 82; Miles City and Fort Smith, 79; Huron, 77; Concordia, 75. The smallest values were: Key West and Point Reyes Light, 19; San Francisco, 24; Tatoosh Island and Fort Smith, 25; Pysht, 27; Galveston and Port Eads, 28.

Accumulated monthly departures from normal temperatures from January 1 to the end of the current month are given in the second column of the following table, and the average departures are given in the third column for comparison with the departures of current conditions of vegetation from the normal condition.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
New England.....	+ 3.6	+ 1.2	North Dakota.....	- 8.8	- 2.9
Middle Atlantic.....	+ 2.1	+ 0.7	Northern Slope.....	- 4.6	- 1.5
South Atlantic.....	+ 0.7	+ 0.2	Southern Plateau.....	- 5.7	- 1.9
Florida Peninsula.....	+ 3.9	+ 1.3	Middle Plateau.....	- 8.8	- 2.9
East Gulf.....	+ 2.2	+ 0.7	North Pacific.....	- 2.6	- 0.9
West Gulf.....	+ 5.8	+ 1.9	Middle Pacific.....	- 5.8	- 1.9
Ohio Valley and Tenn....	+ 3.0	+ 1.0	South Pacific.....	- 4.1	- 1.4
Lower Lake.....	+ 3.9	+ 1.3			
Upper Lake.....	+ 7.8	+ 2.6			
Upper Mississippi Valley..	+ 3.3	+ 1.1			
Missouri Valley.....	+ 1.4	+ 0.5			
Middle Slope.....	+ 2.0	+ 0.7			
Southern Slope.....	+ 1.2	+ 0.4			
Northern Plateau.....	+ 3.0	+ 1.0			

MOISTURE.

The *quantity of moisture* in the atmosphere at any time may be expressed by the weight of the vapor coexisting with the air contained in a cubic foot of space, or by the tension or pressure of the vapor, or by the temperature of the dew-point. The mean dew-point for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, is given in Table I.

The *rate of evaporation* from a special surface of water on muslin at any moment determines the temperature of the wet-bulb thermometer. The mean wet-bulb temperature is now published in Table I; it is always intermediate, and generally about half way between the temperature of the air and of the dew-point. The quantity of water evaporated in a unit of time from the muslin surface may be considered as depending essentially upon the wet-bulb temperature, the dew-point, and the wind.

The *relative humidity*, or the ratio between the moisture that is present in the air and the moisture that it would contain if saturated at its observed temperature is given in Table I as deduced from the 8 a. m. and 8 p. m. observations. The general average for a whole day or any other interval would properly be obtained from the data given by an evaporimeter, but may also be obtained, approximately, from frequent observations of the relative humidity.

PRECIPITATION.

[In inches and hundredths.]

The *distribution of precipitation* for the current month, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III. The total precipitation for the current month exceeded 10 inches on the coast of Oregon and Washington, as also over a large portion of Arkansas, southern Missouri, Illinois, Indiana, northern Alabama, Mississippi, and the greater part of Georgia and Tennessee; it exceeded 18 inches in the central portion of this region. The rainfall was less than 1 inch in southern Florida and the southern Plateau Region. The larger values for regular stations were: Montgomery, 12.02; Tatoosh Island, 11.31; Astoria, 11.88; Little Rock, 10.43; Memphis, 10.04; Chattanooga, 11.23.

Details as to *excessive precipitation* for March are given in Tables XI and XII.

The *years of greatest and least precipitation* for March are given in the REVIEW for March, 1890. The precipitation for the current month was the greatest on record at: Montgomery, 12.02; Little Rock, 10.43; Cincinnati, 9.89; St. Louis, 8.25; Columbus, Mo., 5.33; Abilene, 4.02; Idaho Falls, 3.84; Minneapolis, 3.05; Carson City, 2.78; Cheyenne, 2.32; Santa Fe, 2.06. It was the least on record at: Tampa, 1.44; Wilmington, 1.23.

The *diurnal variation*, as shown by tables of hourly means of the total precipitation, deduced from the self-registering gauges kept at the regular stations of the Weather Bureau, is not now tabulated.

The *current departures* from the normal precipitation are given in Table I, which shows that precipitation was in excess in the valleys of the Ohio, Tennessee, and Arkansas, as also in Ontario, Canada. The large excesses were: Cincinnati, 6.6; Montgomery, 5.6; Chattanooga and Little Rock, 5.2; St. Louis and Astoria, 4.8; Knoxville, Memphis, and Palestine, 4.2. In Canada, Port Stanley, 1.6; Rockville, 1.4. The large deficits were: Wilmington, 2.7; Hatteras, 2.3; Atlantic City, 1.10. In Canada, Sydney, 1.1; Chatham, 1.0.

The *average departure* for each district is given in Table I. By dividing each current precipitation by its respective normal the following corresponding percentages are obtained (precipitation is in excess when the percentage of the normal exceeds 100):

Above the normal: East Gulf, 105; west Gulf, 165; Ohio Valley and Tennessee, 177; lower Lake, 123; upper Lake, 149; North Dakota, 171; upper Mississippi, 181; Missouri Valley, 141; northern Slope, 200; middle Slope, 120; southern Slope, 267; southern Plateau, 136; middle Plateau, 121; northern Plateau, 159; north Pacific, 129; middle Pacific, 122.

Below the normal: New England, 83; middle Atlantic, 74; south Atlantic, 85; Florida Peninsula, 86; south Pacific, 95.

The total accumulated monthly departures from January 1 to the end of the current month are given in the second column of the following table: The third column gives the percentage of the current accumulated precipitation relative to its normal value.

Districts.	Accumulated departures.	Accumulated precipitation.	Districts.	Accumulated departures.	Accumulated precipitation.
	Inches.	Per cent.		Inches.	Per cent.
South Atlantic.....	+ 0.30	102	New England.....	- 2.40	79
Florida Peninsula.....	+ 0.40	105	Middle Atlantic.....	- 2.00	82
West Gulf.....	+ 0.60	106	East Gulf.....	- 0.30	93
Ohio Valley and Tenn.....	+ 2.30	118	Lower Lake.....	- 0.50	84
North Dakota.....	+ 1.60	171	Upper Lake.....	- 0.10	99
Upper Mississippi Valley.....	+ 5.30	187			
Missouri Valley.....	+ 2.40	156			
Northern Slope.....	+ 0.80	139			
Middle Slope.....	+ 0.90	128			
Abilene (southern Slope).....	+ 1.40	147			
Southern Plateau.....	+ 1.50	137			
Middle Plateau.....	+ 1.50	134			
Northern Plateau.....	+ 0.60	111			
North Pacific.....	+ 1.00	105			
Middle Pacific.....	+ 0.40	103			
South Pacific.....	+ 2.20	135			

SNOWFALL.

The total monthly snowfall at each station is given in Tables I and II; its geographical distribution is shown on Chart V. This chart also shows the isotherms of minimum 32° and of minimum 40° for the air within the ordinary thermometer shelter. The former isotherm is an approximate limit to possible snow, while the latter is an approximate southern limit to the regions that report frost in exposed localities.

Snowfalls of from 1 to 10 inches were reported from the interior of the Middle Atlantic States; from 5 to 40 inches in New England; 5 to 10 in the lower Lake Region; 10 to 40 in the upper Lake Region and a narrow belt extending westward into the Dakotas. The heaviest snows reported in the Rocky Mountain Region were: in Colorado, 210; Utah, 52; Idaho, 62; Nevada and California, 152; Washington, 42; Oregon, 139.

The depth of snow on the ground at the end of the month is shown on Chart VI; it is also shown on the weekly charts of the Climate and Crop Service. At the close of March the distribution of snow on the ground was very irregular, and is, therefore, shown by the maximum figures given on Chart VI, 10 inches or more were found in northern New Hampshire, Minnesota, and North Dakota.

In Canada.—The following items are gathered from the map for March, published by Prof. R. F. Stupart:

British Columbia; on the French northwest coast snow had disappeared except on the mountains; Craigellachi (latitude, 51° 0' north; longitude, 118° 40' west), at the foot of the Selkirks, 13 inches of snow, but going fast; at other stations to the southward there was also much snow on the ground, but thawing fast. Alberta; Edmonton, 2 feet of snow in the country districts; Calgary, heavy snow drifts impeding travel, but rapidly disappearing. Assiniboia; Medicine Hat, no snow, ice rapidly breaking up in the South Saskatchewan River; Swift Current, only small patches of snow left on a

level, but hills and ravines not yet bare; Qu'Appelle, snow going fast. Saskatchewan; Prince Albert, snow disappearing fast. Manitoba, Minnedosa, great quantities of snow, roads almost impassable, but bare patches on the hills. Ontario; Port Arthur, as yet there are very few bare places to be seen on the hills and sleighing is very good. New Brunswick and Quebec, much snow still left. Nova Scotia, the greater part clear of snow.

ICE.

The thickness of ice in the rivers and harbors is shown in detail in the bulletins published every Monday by the Weather Bureau, and is also given in some detail in the chapter on "River and Flood Service." The more prominent characteristic data for the first and last Mondays, March 1 and 29, respectively, are:

Maine, Eastport, 21 and 17 inches, Gardiner, 15 and 7, Lewiston, 23 and 12; Michigan, Marquette, 2.5 and 7.0, Sault Ste. Marie, 16 and 15; Minnesota, Duluth, 24.5 and 19, Moorhead, 36 and 38; North Dakota, Bismarck, 35 and 32, Williston, 34 and 34.

The reports of ice in rivers on the 29th were as follows: Androscoggin, Lewiston, Me., ice not yet out of the river. Hudson River, Albany, no ice in the Mohawk and lower Hudson. Mississippi River, St. Paul, ice mostly gone out; St. Louis, rivers open and free from ice. Lake Erie, Buffalo, drift ice covers the lake; Cleveland, no ice in sight. Lake St. Clair, with the Detroit and St. Clair rivers, practically free of ice. Lake Huron, Port Huron, no ice in the lower end of the lake; the first boat down Lake Huron opened navigation on the 27th, and the first steamer from Detroit opened navigation on the 25th. Lake Michigan, Straits of Mackinac, still filled with solid ice; Milwaukee, river and harbor and lake clear of ice: Grand Haven, river and harbor free from ice and very little in the lake. Lake Superior, Sault Ste. Marie, ice 15 inches thick in the harbor, but the river channel is open; Marquette, ice 1 inch thicker than last week and extends 30 miles from the shore, having drifted with high north winds; Duluth, ice from 2 to 4 inches thinner than last week, but firm as far as can be seen from shore. For further details see the weekly Snow and Ice Chart.

In Canada.—Prof. R. F. Stupart reports:

Alberta, Bow River, Calgary, 36 inches. Saskatchewan, Battleford, 24. Assiniboia, Swift Current Creek, Swift Current, 28. Ontario, Lake Superior, Thunder Bay, 16; White River, White River station, 18; Lake Ontario, Bay of Quinte, Kingston, 8; Ottawa River, Rockcliffe, 18; Georgian Bay, Midland, 16. New Brunswick, Miramichi River, Chatham, 14. Prince Edward Island, Hillsboro Bay, Charlottetown, 7. Cape Breton, Sydney River, Sydney, 18. New Brunswick, Passamaquoddy Bay, St. Andrews, 20.

The preceding data is taken from the monthly map for March, but the names of the rivers and bays have been added by the Editor.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 14, 21, 22, 23. Arizona, 15. Arkansas, 7, 15, 21. California, 1, 5, 6, 10, 14, 16 to 19, 28. Colorado, 7, 16. Connecticut, 24. Georgia, 11, 12, 31. Idaho, 25. Illinois, 8 to 11, 19 to 23, 31. Indiana, 8, 9, 10, 19, 21 to 24. Indian Territory, 4, 9, 11, 13, 30, 31. Iowa, 4, 5, 7, 8, 21, 28. Kansas, 4, 18, 19, 22, 30, 31. Kentucky, 9, 15, 21, 22, 23, 31. Louisiana, 15, 21, 28, 31. Maryland, 3, 24. Michigan, 20. Minnesota, 27. Mississippi, 10 to 13, 19, 22, 30, 31. Missouri, 4, 8, 9, 19, 20, 28, 30, 31. Nebraska, 7, 28, 30, 31. New Jersey, 19, 24. New Mexico, 15, 16. New York, 20. North Carolina, 13, 15. Ohio, 8, 9, 21, 22, 24. Oklahoma, 18, 30. Oregon, 5, 6, 8 to 11, 16 to 20, 23, 25 to 30. Pennsylvania, 20. Tennessee, 3, 11, 12, 13, 22, 31. Texas, 4, 5, 10, 14, 15, 18, 21, 28, 30, 31. Vermont, 20. Virginia, 24. Washington 4. Wyoming, 29.

SLEET.

The following are the dates on which sleet fell in the respective States:

Arkansas, 15. California, 1, 2, 3, 5 to 11, 13, 18, 19, 20, 28, 29. Colorado, 1, 2, 6, 7, 16, 30, 31. Connecticut, 5, 14. District of Columbia, 6. Idaho, 6, 9, 10, 13, 17, 19, 23 to 29. Illinois, 1 to 4, 7, 8, 9, 12, 13, 19, 20, 21, 23, 24, 28. Indiana, 1, 2, 3, 8, 13, 14, 23. Indian Territory, 3. Iowa, 1, 2, 4 to 7, 9, 11, 13, 21, 28. Kansas, 1 to 4, 6, 13, 14, 21, 22, 23, 31. Kentucky, 15, 24, 25. Maine, 3, 5, 9, 10, 21, 24, 28. Maryland, 4 to 7, 12, 13, 14, 24. Massachusetts, 5, 14, 20, 24. Michigan, 1 to 5, 8, 9, 13, 14, 19, 23, 25, 28, 29. Minnesota, 1, 4, 5, 8, 16 to 19. Missouri, 1 to 4, 7, 8, 11, 13, 21, 23, 25, 31. Montana, 18, 30. Nebraska, 4, 6, 7, 9, 18, 21, 30, 31. Nevada, 1, 2, 3, 5, 7, 8, 16, 17, 19, 28, 29. New Hampshire, 3, 5, 12, 20, 22. New Jersey, 5, 14, 24. New York, 1, 2, 5, 8, 13, 14, 22, 24. North Dakota, 8, 17, 20, 27, 28, 29. Ohio, 1, 2, 4, 5, 14, 20 to 25. Oklahoma, 2. Oregon, 4, 5, 8, 9, 10, 16 to 21, 27 to 31. Pennsylvania, 4, 5, 9, 12, 14, 20, 23, 24, 25, 27. South Dakota, 4, 7, 8, 11, 23, 24, 28. Tennessee, 12, 14, 15, 24. Utah, 1, 4 to 8, 12, 16 to 20, 28, 29, 30. Vermont, 2, 3, 5. Virginia, 5, 6, 9, 13, 14, 15. Washington, 4, 5, 7 to 11, 16 to 22, 25 to 27. West Virginia, 14. Wisconsin, 4, 5, 7, 8, 19, 29.

WIND.

The prevailing winds for March, 1897, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The resultant winds, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table VIII. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

HIGH WINDS.

Maximum wind velocities are given in Table I, which also gives the altitudes of the Weather Bureau anemometers above the ground. Maxima of 50 miles or more per hour were reported during this month at regular stations of the Weather Bureau as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				Miles	
Amarillo, Tex.....	19	52	w.	Erie, Pa.....	14	54	s.
Do.....	30	64	sw.	Fort Canby, Wash.....	17	68	s.
Atlanta, Ga.....	14	52	n.	Do.....	25	95	s.
Do.....	19	50	sw.	Do.....	27	32	s.
Buffalo, N. Y.....	5	54	w.	Lexington, Ky.....	5	50	sw.
Do.....	12	76	w.	New York, N. Y.....	13	53	nw.
Do.....	14	69	w.	Do.....	24	57	w.
Cairo, Ill.....	5	56	s.	Do.....	25	54	w.
Do.....	18	54	sw.	Northfield, Vt.....	6	50	nw.
Do.....	28	52	sw.	Portland, Ore.....	25	55	s.
Cleveland, Ohio.....	5	50	se.	Port Huron, Mich.....	12	53	sw.
Do.....	12	52	w.	Do.....	14	50	sw.
Do.....	14	56	w.	Pueblo, Colo.....	31	54	nw.
Do.....	24	53	nw.	Tatoosh Island, Wash.....	10	60	nw.
Dodge City, Kans.....	30	51	sw.	Do.....	25	60	w.
Eastport, Me.....	12	50	se.	Vicksburg, Miss.....	14	52	n.
El Paso, Tex.....	4	60	sw.	Winnemucca, Nev.....	28	66	sw.
Do.....	20	52	sw.	Woods Hole, Mass.....	12	56	s.
Do.....	28	51	w.	Do.....	25	60	w.
Do.....	30	56	nw.				

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from

year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 22 regular stations of the Weather Bureau by its photographic, and at 37 by its thermal effects; at one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table X for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun in the hours after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table X.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the durations of effective sunshine whence the durations relative to possible sunshine are derived; the observers' personal estimates give the percentage of area of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for March, 1897, is 8 per cent for photographic and 7 per cent for thermometric records.

The details are shown in the accompanying table, in which the stations are arranged according to the total possible duration of sunshine, and not according to the observed duration.

Difference between instrumental and personal observations of sunshine.

Stations.	Latitude.	Apparatus.	Total possible duration for the whole month.	Personal estimated area of clear sky.	Photographic.	Difference.	Thermometric.	Difference.
			Hrs.	%	%	%	%	%
Tampa, Fla.....	27 57	T.	373.8	59	59	0	64	+ 5
Galveston, Tex.....	29 18	P.	373.6	25	35	0	26	0
New Orleans, La.....	29 58	T.	373.5	26	35	0	26	0
Savannah, Ga.....	32 05	P.	373.1	36	40	+ 4	54	0
Vicksburg, Miss.....	32 32	T.	373.1	54	54	0	54	0
San Diego, Cal.....	32 43	P.	372.3	57	68	+11	50	0
Charleston, S.C.*.....	33 47	T.	372.3	36	36	0	36	0
Phoenix, Ariz.....	33 28	P.	372.3	77	83	+ 6	26	+ 4
Atlanta, Ga.....	33 45	T.	372.3	23	23	0	26	+ 4
Los Angeles, Cal.....	34 03	P.	372.3	57	70	+13	51	+ 4
Wilmington, N. C.....	34 14	T.	372.3	47	47	0	51	+ 4
Little Rock, Ark.....	34 45	T.	372.1	41	41	0	52	+11
Chattanooga, Tenn.....	35 04	T.	372.1	30	30	0	25	- 5
Santa Fe, N. Mex.....	35 41	P.	371.9	63	75	+12	50	+12
Raleigh, N. C.....	35 45	T.	371.9	36	36	0	48	+12
Nashville, Tenn.....	36 10	T.	371.9	38	38	0	50	+12
Fresno, Cal.....	36 42	T.	371.7	66	66	0	68	- 3
Dodge City, Kans.....	37 45	P.	371.4	58	59	+ 1	50	0
San Francisco, Cal.....	37 48	T.	371.4	54	54	0	62	+ 8
Louisville, Ky.....	38 15	T.	371.4	32	32	0	47	+15
St. Louis, Mo.....	38 38	T.	371.4	32	32	0	46	+14
Washington, D. C.....	38 54	P.	371.4	49	58	+ 9	40	0
Kansas City, Mo.....	39 05	P.	371.4	43	43	0	40	0
Cincinnati, Ohio.....	39 08	T.	371.4	35	35	0	44	+ 9
Baltimore, Md.....	39 18	T.	371.4	43	43	0	50	+ 7